Oil and Gas Industries Meeting Notes
June 23-24, 1999

Opening Comments

On June 23rd and 24th 1998, the Greenhouse Gas Technology Verification Center hosted two meetings with the Oil and Natural Gas industries. Attendees at the first meeting (The Operator Meeting) included, producers, transmission companies, service providers, and environmental consultants. Attendees at the second meeting included, vendors of compressor seals, valves, fittings, and other GHG reduction technologies. All attendees were invited to join the Oil and Gas Industries Stakeholder Group.

Although identified as currently lacking, both groups expressed a need for independent performance verification data, and both helped the Center identify and prioritize parameters and technology types most in need of verification. Most participants acknowledged that the ETV Program had a role to play in increasing the availability of dependable verification data in the GHG technology area, and several strategies for accomplishing that were discussed.

The Operator Meeting notes can be found below.

Summary of the Operator Meeting
June 23, 1998

Holiday Inn Select, Houston, TX

Meeting Overview

The meeting started with welcoming remarks from Stephen Piccot. Mr. Piccot summarized the meeting goals, desired outcomes, and agenda. He presented the Greenhouse Gas Technology Verification Center's (the Center) Mission Statement. He discussed operating principles of the Environmental Technology Verification (ETV) program, outlined the Center's programmatic goals and strategies, and described factors and events leading up to the establishment of the 12 ETV pilots. Dr. David Kirchgessner also offered welcoming comments, and stressed the importance EPA places on receiving industry guidance. He expressed hope that the meeting participants would become advocates for the Center's mission, and assist in prioritizing verification testing candidates.

After the welcoming remarks, each participant introduced themselves. Attachment A lists the individuals present at the meeting, and identifies those individuals that expressed a strong interest in participating in the program, but were unable to attend. Following the introductions, Mr. Andy Taer of GeoSciences, Inc., discussed his company's experience in the ETV program. He started out by making an analogy of the ETV program as being

similar to the Consumer Reports. He identified several benefits of going through the verification process, such as the ability to use the verification statement and report as marketing tools. He identified some weaknesses in his ETV experience, including: a lack of outreach activities, timeliness, and tests being conducted under relatively narrow field conditions.

Mr. Taer's talk was followed by Sushma Masemore's discussion on the technology verification process. She presented the ranked order list of greenhouse gas (GHG) mitigation technology focus areas identified by the Center's Executive Stakeholders. She indicated that the oil and natural gas industries were ranked at the top of the list, and that this meeting was organized to gauge industry interest in ETV and prioritize technologies to be tested.

Ms. Masemore described the solicitation, selection, testing, and reporting activities that the Center will execute. The process described consisted of: (1) inviting vendors to submit pre-test applications, (2) conducting engineering evaluations to determine their readiness for testing, (3) preparing initial test plans based on input from the oil/gas industry technology stakeholder group, (4) negotiating/signing commitment letters, (5) preparing test and quality assurance plans, (6) executing verification tests, and (7) reporting and distributing performance results. The results will be reported in two formats. A verification report, a mandatory requirement for participating, and a verification statement. The Center plans to start at least one test by the fall of this year. Additional technologies will be tested, and new technology prioritization exercises will occur over the next 3 to 5 years.

Following this talk, a joint presentation by Mr. Bob Lott of the Gas Research Institute and Mr. Don Robinson of ICF Kaiser, Inc., focused on GHG emissions from the oil and gas industries, and specific technologies that reduce methane emissions. This technology list, presented in Attachment B, became the focal point for conducting open discussions later in the day. The operators provided additional technologies not included in the list, and voted on technologies that would be good candidates for verification testing.

Following lunch, the open discussion was initiated. The session was fruitful and many specific issues were addressed. At the outset, the topics proposed for discussion included: Topic 1- Prioritization of technologies to test and Topic 2- Information to be produced from ETV testing. Highlights from the discussions are summarized below.

Topic 1: Prioritization of Technologies to Test

In this session, the operators were asked to supplement the technology list, shown in Attachment B, with additional options not yet identified. Five new technologies were added to this list. These include: electro-mechanical valve control devices, micro-turbines, down hole water separation units, regenerator vapor conditioners, and technologies that recover low pressure gas. The operators felt that the modified list was

fairly comprehensive, and suggested that additional industry input may be obtained from organizations such as the Petroleum Technology Transfer Council. Following this, four exercises were conducted to clarify the group's opinion on specific technologies and their utility to the industry. The participants were asked to place color-coded stickers next to individual technology names.

In the first exercise, the operators were asked to identify technologies that they are currently employing. In general, the majority of categories listed in Attachment B were utilized by one or more members of the group. In a similar exercise, the operators identified technologies that are likely to never penetrate the market for cost or other reasons. In particular, any technology involving nitrogen as an initial energy source was regarded as too expensive.

The participants were then asked to identify technologies that would be employed if money were not an object. The operators perceived these technologies as good ideas, but were either unsure of costs or concerned about poor cost effectiveness. Examples of these include a significant number of compressor station emission reduction technologies (e.g., leak capture and reinjection devices, advanced compressor seal designs, and optical-based leak detection methods). Other relatively new technologies were also identified, including electro-mechanical valve controllers, low pressure gas recovery systems, and micro-turbines.

In the final exercise, the operators identified technologies that would be good candidates for ETV (i.e., verified performance data would be welcomed by industry to make informed purchasing decisions). In general, these technologies were also selected as "blue chip" test candidates, suggesting that utilization of these options would increase if verification data were available and cost-effective performance could be demonstrated. The items selected most often include (in order):

1. All technologies capable of reducing leaks from compressor seals (i.e., new advanced compressor seals, leak capture/reinjection devices, and static packs)
2. Use of smart regulators in distribution systems,
3. Recovery of low pressure gas and subsequent utilization,
4. Regenerator vapor conditioner system,
5. Micro-turbines, and
6. Electro-mechanical valve controls.

Attachment C lists specific issues discussed on these technologies, and highlights key points made on other technologies that did not make the list. At the conclusion of the open discussion, the participants were informed that the rank ordered list will be used by the Center to invite vendors for the first round of testing.

Topic 2: Information To Be Produced From ETV Testing

In an open discussion, the operators were asked if a need for ETV performance testing existed in the oil and gas industry. This was followed by brainstorming exercises to identify verification test parameters. Overall, there appeared to be broad support for the ETV program, and most participants felt that the industry could benefit from independent testing. They emphasized that ETV should not dismiss existing technologies, such as static packs, since test data for these technologies can increase industry confidence, and help them understand their full performance capability.

During the discussion of verification test parameters, the operators unanimously indicated that technology cost and cost benefit data was essential. They suggested that, at a minimum, the report should include all capital, operating, and maintenance costs for the technology, as well as its impact on existing equipment and operating requirements. The report should also provide information on pay out periods by conducting cost benefit evaluations between new and existing technologies. Additional comments on verification test parameters are summarized in Attachment D.

The operators also suggested that ETV should provide data on GHG emission reductions and other regulated pollutants. They stated that consistency with national and international verification protocols should be maintained to facilitate future GHG emission trading and credit claims. The technologies should be tested at representative field sites, as defined by industry stakeholders. The report should specify the type and size of test sites, so operators can compare their facilities with the test sites. The participants also suggested that ETV examine and report technology reliability and durability. Specifically, if a technology requires additional operating and maintenance, these impacts should be integrated into the technology cost evaluations. They suggested that existing data on units that are currently in operation may be used to quantify long-term durability issues.

At the conclusion of the open discussion, the Center coordinators described the roles of the oil/gas industries stakeholder group. Participants were invited to become stakeholders if they were interested in recommending technologies and test parameters. They were informed that the Center will strive to form a diverse group of members (about 25) comprised of operators, regulators, consulting engineers, service providers, and technology vendors. The Center will select members within two weeks, and notify them of their status soon after.

The meeting was adjourned after Mr. Brian Phillips made concluding remarks. He informed the operators that a similar meeting was to be held with technology vendors on the following day, and he invited interested operators to attend. He indicated that the vendors would be presented with today's results, and additional feedback on the Center's activities will be sought. Mr. Phillips concluded the meeting by highlighting the next steps. These included: (1) conducting a similar meeting with technology vendors the following day, (2) inviting vendors to participate and submit pre-test applications for the top 2-3 candidate technologies, (2) finalizing the stakeholder group make-up, (3)

preparing an initial test plan and obtaining stakeholder guidance for the first test, (4) negotiating and signing commitment letters for this test, and (5) preparing a test/QA plan.

Attachment A

Oil/Natural Gas Industry Representatives Interested In The ETV Program

Amoco Corporation* Vick Newsom** ARCO Exploration & Production Technology* Brian Shannon Colorado Interstate Gas Company* James Easton Conoco, Inc.* Andy Shah** El Paso Natural Gas Tom Hutchins Enron Gas Pipeline Group* Bill Kendrick** Oryx Energy Company* Dr. Patrick Grizzle** Texaco EPTD* Vernon Scheivelbein / Arthur Lee** Chevron USA Production Co. Robert Sandilos Hanover Compression* John Snow** Cornerstone Environmental* John Alderman** Southern Natural Gas Company* John Seymour** Mobil Oil Phil Berton Marathon Oil* Bill Doyle WZI, Inc.* Jesse Frederick** Williams Gas Pipelines – Central* David Farrand** Tennessee Gas Pipeline Co.* Paul Carney Gas Research Institute* Bob Lott ANR Pipeline Company Joe Weisbrod** Exxon Company, U.S.A. C. Mark Pike Texas Gas Transmission Group Stewart Lathan Fina Oil and Chemical Ron Smelley Petroleum Technology Transfer Council Lance Cole Kerr-McGee Corporation Stuart Wittenbach American Petroleum Institute (API) Glenda Smith Canadian Gas Association Jennifer Keyes * Present at the Houston Meeting on June 23 or June 24
** Signed up to become a stakeholder

Attachment B

Results Of Technology Prioritization Activities

Category	Technology	Applicable to		Voting Results[1]			
		Production Sector	Transmission & Distribution Sector	A	B	C	D
Gas Compressor Systems	Replace Wet Seals with Dry Seal Systems in Centrifugal Compressors, Compressor Seal Leak Capture and Reinjection Devices*		☑	2	7		9

	Install Electric Compressors	☑		2	3	5	
	Install Electric Starter	☑	☑			1	
	Use of Gas Turbines at Compressor Stations		☑	5	2	1	
	Replace Ignition System to Reduce False Starts	☑	☑	1			
	Convert Engine Starting to Nitrogen	☑				9	
	Install Instrument Air Compressor	☑		2			
	Install Electric Motors		☑		1		
	Use Catalytic Converters on Compressors	☑		5			2
	Use Clocking Solenoids		☑				
Vapor Recovery	Install Vapor Recovery Units on Crude Tanks	☑		5			
	Use Nitrogen Eductors for Vapor Recovery	☑				9	
Separators	Install Flash Tank Separators on Glycol Dehydration Units	☑	☑	6			
	Install Pumps for Separators	☑					
Glycol Dehydration	Link Dehydrator Unit to Incinerator	☑		4			
	Use Electric Pumps in Glycol Dehydrators	☑		3			
Pneumatics	Pneumatic Device Replacement (High-Bleed with Low-Bleed)	☑	☑	2			
	Convert Pneumatics to Nitrogen/Air/Mechanical Weights	☑					

Leak Detection/ Measurement	Perform Fugitive Emissions Tests	☑		5			
	Leak Measurement	☑	☑	2			
	Leak Detection	☑	☑		3		
Valves/Regulators/ Orifice Meters	Use Smart Regulators*	☑	☑				5
	Install Unit Valve Shut-offs		☑				
	Use Excess Flow Valves		☑				
Pipelines	Replace Plastic Pipe	☑					
	Use Flexible Insert Liners for Gas Mains and Service Lines		☑				
	Identify and Rehabilitate Leaky Dresser Coupled Pipe		☑	1			1
Safety	Install Electronic Safety Devices	☑					
	Install Overpressurization Protection System		☑	1			
Maintenance Practices	Redesign Piping to Reduce ESD from Annual to Triennial Install Drip Trap Ball Control Devices		☑			1	
Other	Make Kimray Replacements/Retrofits	☑	☑	1			
	Convert Gas Driven Chemical Pumps to Electric/Air/Nitrogen	☑		1		7	
	Install Fuel Recovery Systems and Static Packs*		☑	2	3		5
	Install Evacuator	☑				1	
	Install Plunger Lifts in Gas Wells	☑		2			

Venting/Flaring	Modify System Operations to Reduce Venting	☑	☑	2			
	Install Flare System at Tank Batteries	☑		4			
Technologies Added by The Users	Electro-Mechanical Valve Control Devices*	☑	☑		4		2
	Micro-Turbines*	☑	☑		7	1	3
	Down hole water separators	☑		1			
	Regenerator vapor conditioners*	☑		7			4
	Recovery of Low Pressure Separator Gas*	☑	☑		5		5
Technologies Added by The Vendors	New Compressor Seal Rings	☑	☑				
	Valve Stem Leakage Devices	☑	☑				
	Flare Gas Recovery Systems	☑					

[1] A: Unlimited number of votes were allowed for each participant, Represents technologies that are currently employed

B: Three votes were allowed for each participant, Represents technologies that would be implemented if cost effectiveness were known

C: Three votes were allowed for each participant, Represents technologies that may be too costly to penetrate the market

D: Three votes were allowed for each participant, Represents technologies that are good candidates for ETV testing

* Represents technologies prioritized for ETV testing

Attachment C

Operators' Comments On "Blue Chip" GHG Technologies

Technology	Comments and Technology Specific Verification Needs
Compressor Seal Leak Reduction Technologies	-Everyone recognized compressor stations as a significant source of GHG emissions -Reduction or elimination of leaks can equate to gas savings and fewer operating problems -Although static packs have been in existence for many years, uncertainty remains on their performance and reliability -In addition to performance evaluations, cost benefit analyses must be provided for the industry to consider the technology -Performance data for replacing wet seals with dry seals are needed to convince management personnel -The new leak capture and reinjection device looks promising if its cost effectiveness can be demonstrated -The Gas View technology may prove to be useful if its ability to identify large emission sources in a cost effective manner is verified
Low Pressure Gas Recovery Systems	-Industry wants verification data on technologies that use 30 psi gas that is normally vented into the atmosphere -Technologies are available to utilize this gas (e.g. three stage compressors that boost the low pressure gas to high pressure, and utilizing the gas in small power generating engines) -Performance testing would be welcomed to determine if the technology is applicable to their sites
Micro-turbines	-On-site power production with small scale generating equipment could help utilize the off-gas that is normally vented -Performance data and applicability to the oil/gas industry is relatively unknown -Verification would be useful, especially at remote sites where electric power is not available
Regenerator Vapor Conditioners	-Applicable to glycol separators which are significant sources of HAP emissions and other hazardous pollutants -Verification of technologies that reduce these emissions would be useful to the industry in dealing with MACT regulations
Electro-mechanical valve controls	-These electrically powered motor devices maneuver process valves to perform their designed functions -Built in electronic controllers are capable of sensing process conditions, manipulating specific devices, and ultimately controlling stream conditions -They are an alternate to using gas pressure based systems

	-Independent producers may be most interested in this technology -Requires on-site electricity or energy source to power the actuators -Typically applicable to facilities located near urban areas -Cost effectiveness analysis should include upstream and downstream benefits experienced by the devices (e.g., maintenance requirements)
Leak Measurement Devices	-The HiFlow sampler, designed to detect and quantify fugitive leaks, does not need to be verified to gain industry acceptance -Participants agreed fully that it works, and they do not have significant questions on its ability to perform its intended function
Low Bleed Pneumatics	-A few participants voiced concerns about maintenance issues related to small orifices plugging up system components -Others identified the availability of several approaches to reduce these concerns, including variable orifice designs and filter units that maintain clean supply gas -Some participants do not believe that they reduce emissions

Attachment D

Key Verification Parameters Identifies By The Operators

Parameters	Operators' Comments
Technology Costs and Benefits	-Since a regulatory impetus for GHG emission reduction does not exist, industry needs cost information and economic evaluations to determine if the technology is cost effective for their operation -Benefit analysis should provide information on pay out periods (less than 3 years is considered good) -A gas savings factor of $2/1000 cubic feet is a reasonable value to use in cost benefit analysis -ETV report should include all capital and O&M costs for the technology as well as its impact on existing equipment and operating requirements
Technology Performance Capability	-ETV report should clearly state the technology's ability to perform its intended purpose -Technology's operating range should be representative of actual conditions -Report should state potential upstream/downstream impacts when the technology fails to work -GHG emission reduction and other pollutants should be identified and quantified

	amounts and credits should be maintained -Secondary environmental impacts should be addressed and measured if applicable
Technology Applicability	-Test conditions should be representative of actual facilities -If lab tests are conducted, stakeholders should buy off on the idea -Report should specify type and size of test facility so operators can compare their sites with the test site
Maintenance Requirements	-Reliability and durability of instruments should be examined -Existing data on installations that are currently in operation may be used to address this issue -If operating and maintenance requirements are expected to increase, their costs should be integrated in the economic evaluations
Meet Existing Regulatory Requirements	-Information on secondary by-products should be provided -Tests procedures for measuring emissions of regulated hazardous pollutants should be acceptable to permit writers
Other Issues	-Strong peer review is needed -Credible data quality procedures should be followed